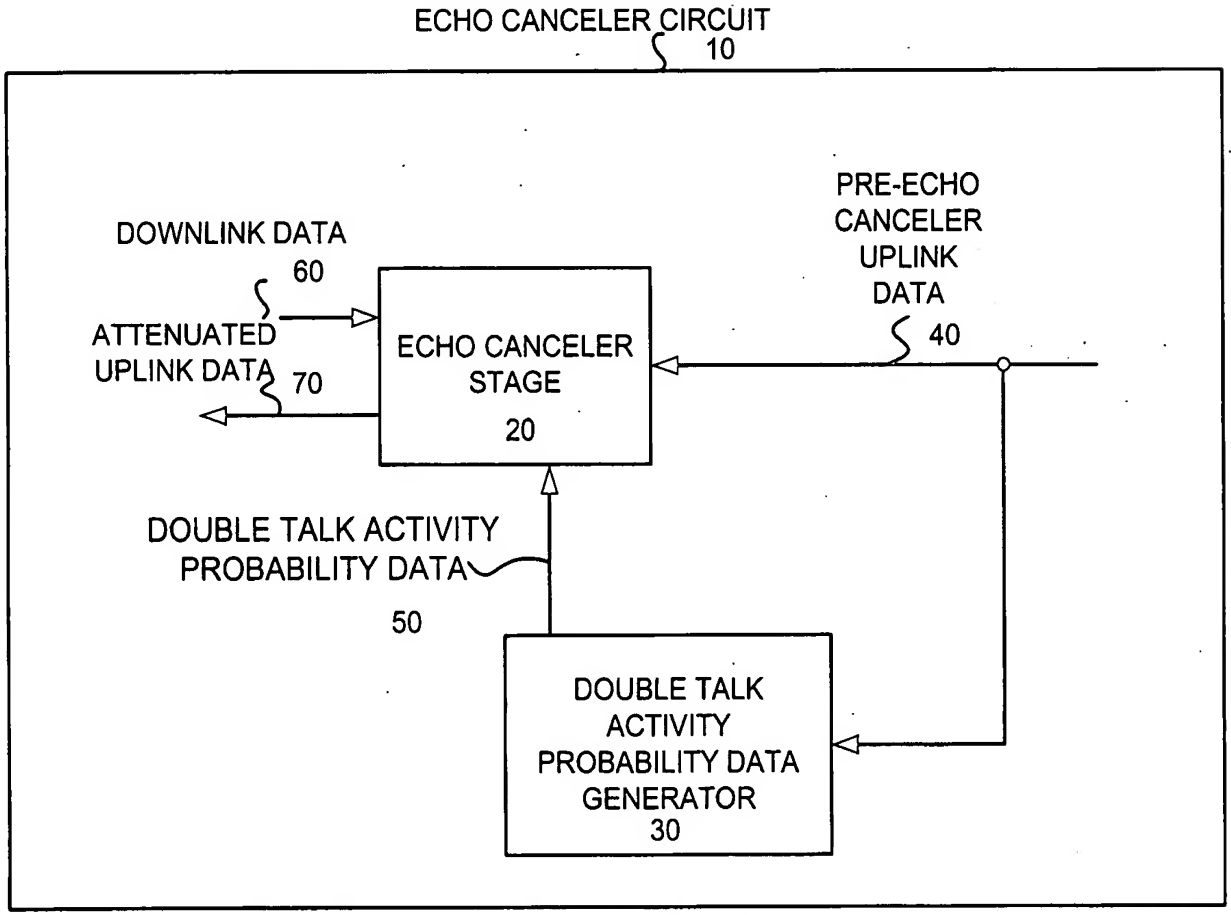
ECHO CANCELER CIRCUIT
10
DOWNLINK DATA
60
ATTENUATED
UPLINK DATA
70
ECHO CANCELER
STAGE
20
PRE-ECHO
CANCELER
UPLINK
DATA
40
DOUBLE TALK ACTIVITY
PROBABILITY DATA
50
DOUBLE TALK
ACTIVITY
PROBABILITY DATA
GENERATOR
30

FIG. 1

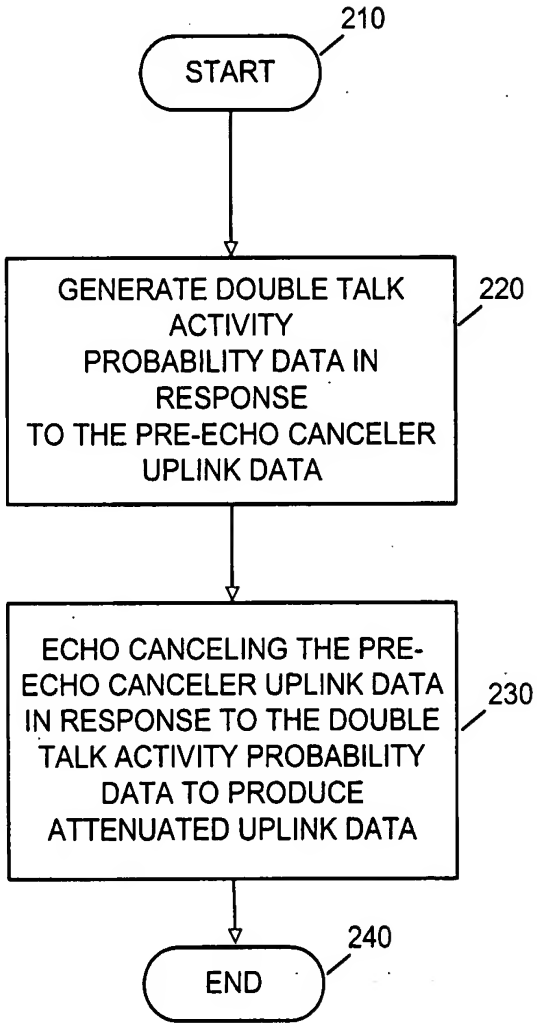
210
START
GENERATE DOUBLE TALK ACTIVITY PROBABILITY DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
220
ECHO CANCELING THE PRE-ECHO CANCELER UPLINK DATA IN RESPONSE TO THE DOUBLE TALK ACTIVITY PROBABILITY DATA TO PRODUCE ATTENUATED UPLINK DATA
230
240
END
200

FIG. 2

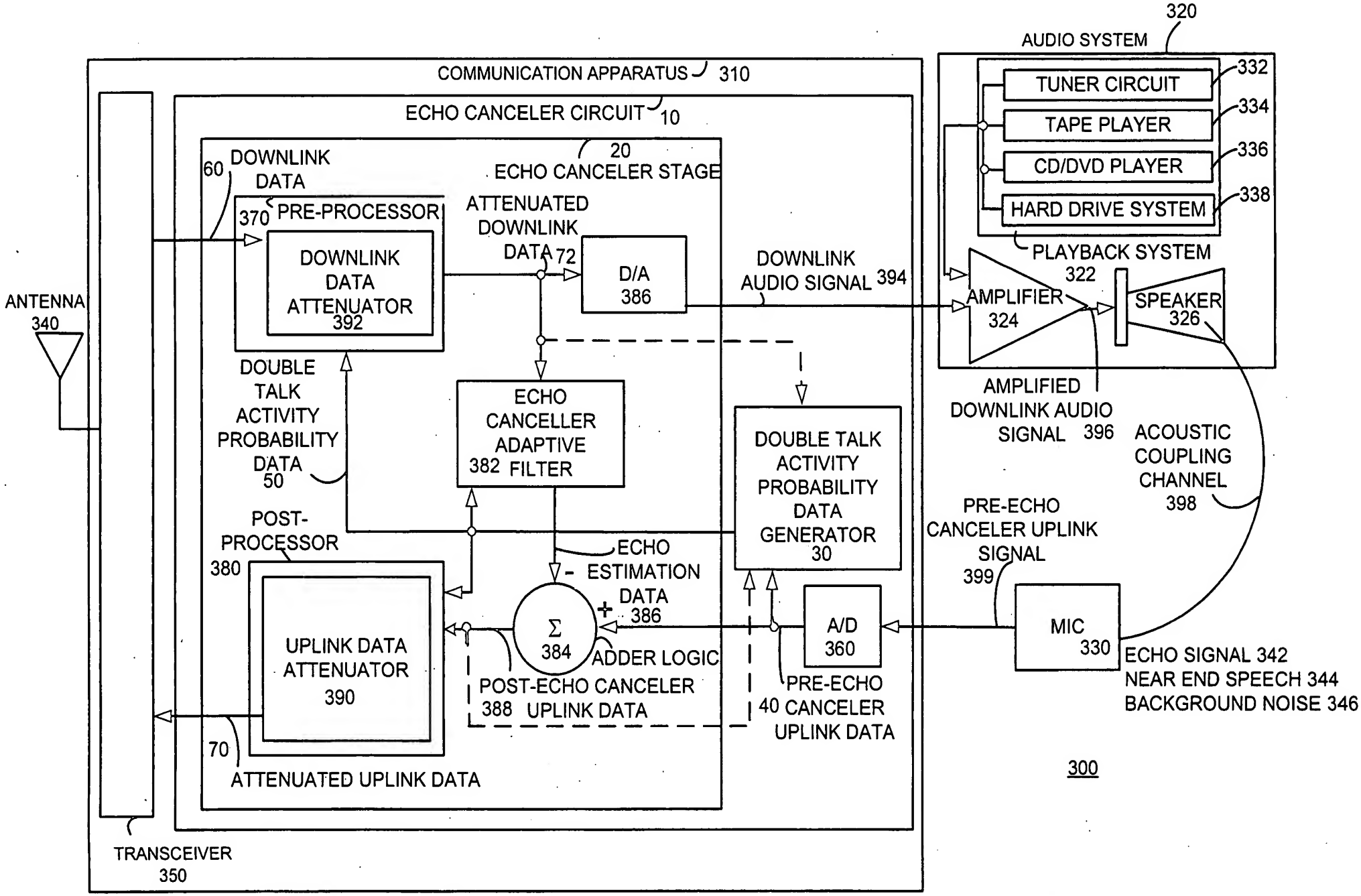
320
AUDIO SYSTEM
COMMUNICATION APPARATUS 310
ECHO CANCELER CIRCUIT 10
20
ECHO CANCELER STAGE
60 DOWNLINK DATA
370 PRE-PROCESSOR
DOWNLINK DATA ATTENUATOR 392
ATTENUATED DOWNLINK DATA 72
D/A 386
DOWNLINK AUDIO SIGNAL 394
TUNER CIRCUIT 332
TAPE PLAYER 334
CD/DVD PLAYER 336
HARD DRIVE SYSTEM 338
PLAYBACK SYSTEM 322
AMPLIFIER 324
SPEAKER 326
ANTENNA 340
DOUBLE TALK ACTIVITY PROBABILITY DATA 50
ECHO CANCELLER ADAPTIVE 382 FILTER
DOUBLE TALK ACTIVITY PROBABILITY DATA GENERATOR 30
AMPLIFIED DOWNLINK AUDIO SIGNAL 396
ACOUSTIC COUPLING CHANNEL 398
POST-PROCESSOR 380
ECHO ESTIMATION DATA 386
PRE-ECHO CANCELER UPLINK SIGNAL 399
UPLINK DATA ATTENUATOR 390
Σ 384
ADDER LOGIC
A/D 360
MIC 330
ECHO SIGNAL 342
NEAR END SPEECH 344
BACKGROUND NOISE 346
POST-ECHO CANCELER 388 UPLINK DATA
PRE-ECHO 40 CANCELER UPLINK DATA
70 ATTENUATED UPLINK DATA
300
TRANSCEIVER 350

FIG. 3

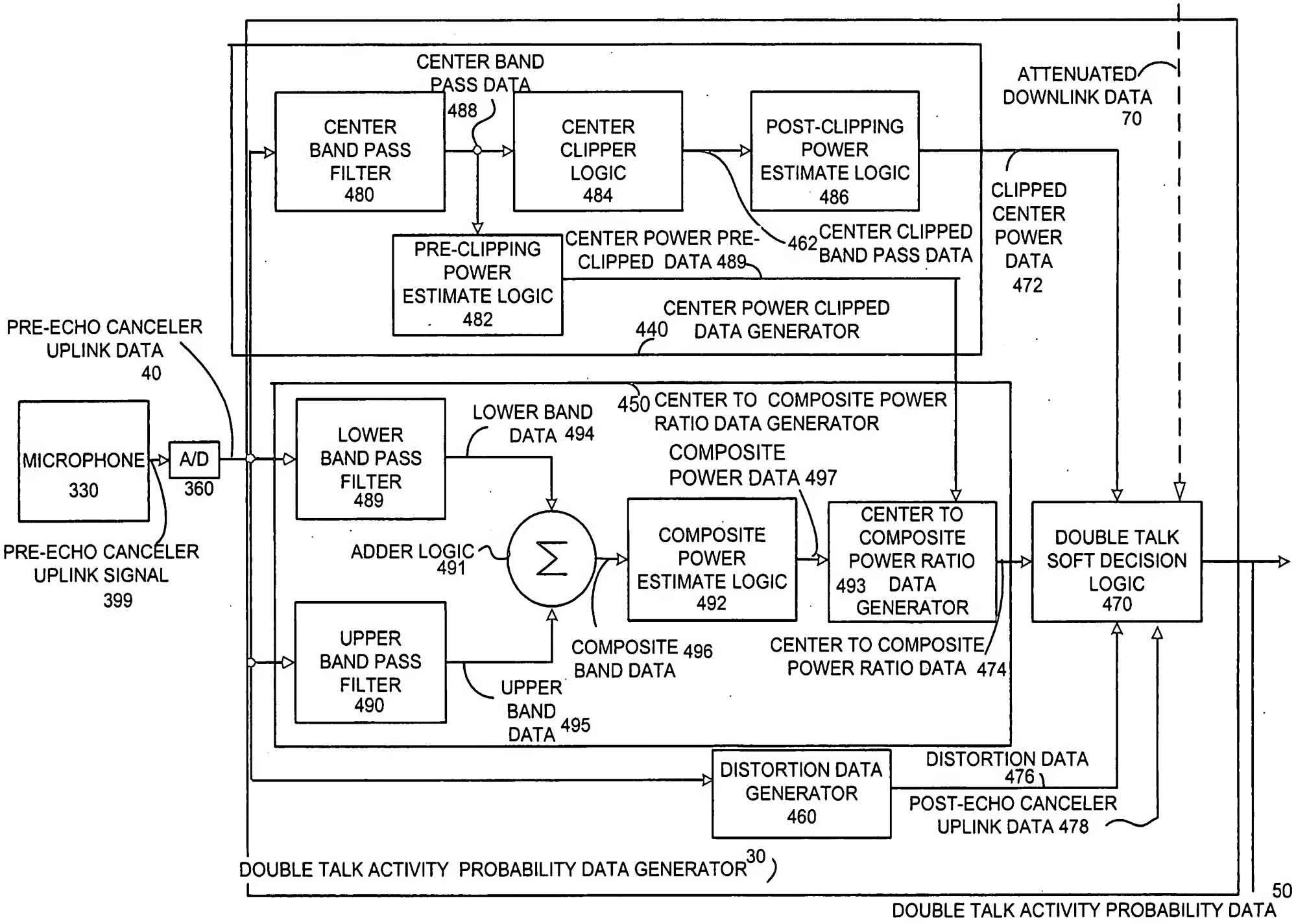
CENTER BAND PASS DATA
488
CENTER BAND PASS FILTER 480
CENTER CLIPPER LOGIC 484
POST-CLIPPING POWER ESTIMATE LOGIC 486
ATTENUATED DOWNLINK DATA 70
CLIPPED CENTER POWER DATA 472
PRE-CLIPPING POWER ESTIMATE LOGIC 482
CENTER POWER PRE-CLIPPED DATA 489
462 CENTER CLIPPED BAND PASS DATA
CENTER POWER CLIPPED DATA GENERATOR 440
PRE-ECHO CANCELER UPLINK DATA 40
450 CENTER TO COMPOSITE POWER RATIO DATA GENERATOR
MICROPHONE 330
A/D 360
LOWER BAND PASS FILTER 489
LOWER BAND DATA 494
COMPOSITE POWER DATA 497
PRE-ECHO CANCELER UPLINK SIGNAL 399
ADDER LOGIC 491
COMPOSITE POWER ESTIMATE LOGIC 492
CENTER TO COMPOSITE POWER RATIO 493 DATA GENERATOR
DOUBLE TALK SOFT DECISION LOGIC 470
UPPER BAND PASS FILTER 490
COMPOSITE 496 BAND DATA
CENTER TO COMPOSITE POWER RATIO DATA 474
UPPER BAND DATA 495
DISTORTION DATA GENERATOR 460
DISTORTION DATA 476
POST-ECHO CANCELER UPLINK DATA 478
DOUBLE TALK ACTIVITY PROBABILITY DATA GENERATOR 30
50
DOUBLE TALK ACTIVITY PROBABILITY DATA

FIG. 4

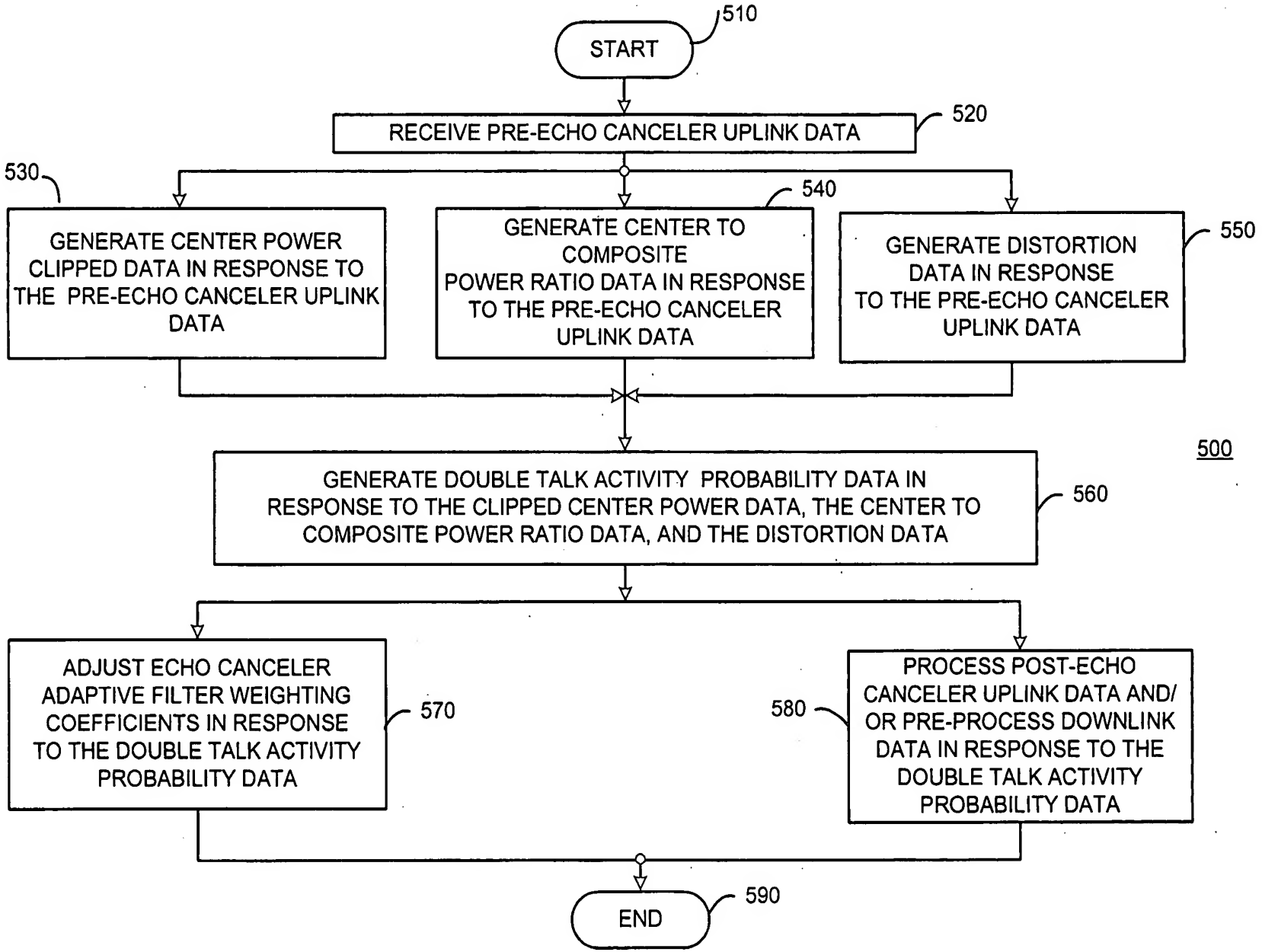
500
510
START
520
RECEIVE PRE-ECHO CANCELER UPLINK DATA
530
GENERATE CENTER POWER CLIPPED DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
540
GENERATE CENTER TO COMPOSITE POWER RATIO DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
550
GENERATE DISTORTION DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
560
GENERATE DOUBLE TALK ACTIVITY PROBABILITY DATA IN RESPONSE TO THE CLIPPED CENTER POWER DATA, THE CENTER TO COMPOSITE POWER RATIO DATA, AND THE DISTORTION DATA
570
ADJUST ECHO CANCELER ADAPTIVE FILTER WEIGHTING COEFFICIENTS IN RESPONSE TO THE DOUBLE TALK ACTIVITY PROBABILITY DATA
580
PROCESS POST-ECHO CANCELER UPLINK DATA AND/ OR PRE-PROCESS DOWNLINK DATA IN RESPONSE TO THE DOUBLE TALK ACTIVITY PROBABILITY DATA
590
END

FIG. 5

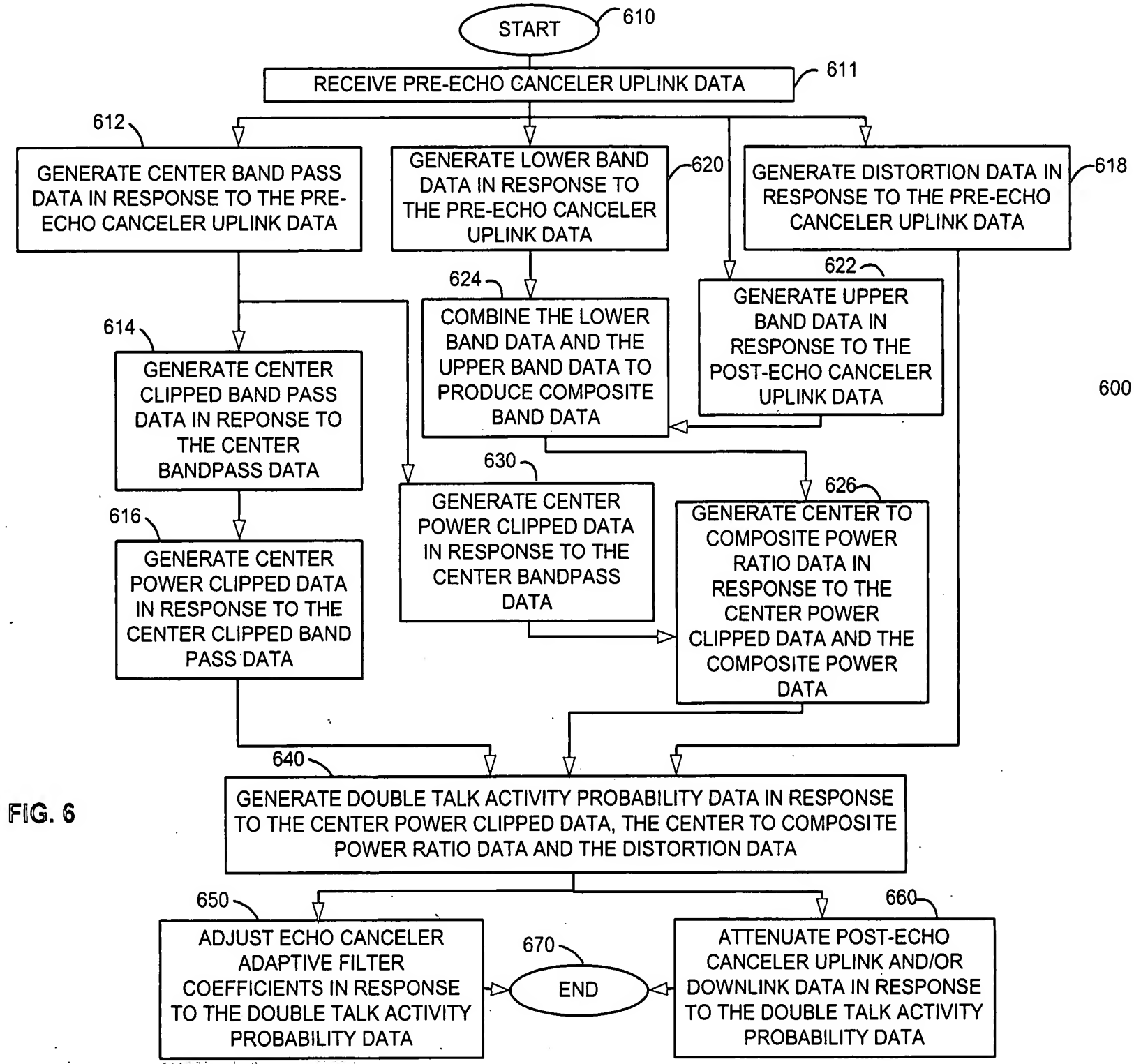
START
610
RECEIVE PRE-ECHO CANCELER UPLINK DATA
611
612
GENERATE CENTER BAND PASS DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
GENERATE LOWER BAND DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
620
GENERATE DISTORTION DATA IN RESPONSE TO THE PRE-ECHO CANCELER UPLINK DATA
618
622
624
GENERATE UPPER BAND DATA IN RESPONSE TO THE POST-ECHO CANCELER UPLINK DATA
COMBINE THE LOWER BAND DATA AND THE UPPER BAND DATA TO PRODUCE COMPOSITE BAND DATA
614
GENERATE CENTER CLIPPED BAND PASS DATA IN REPONSE TO THE CENTER BANDPASS DATA
630
626
GENERATE CENTER POWER CLIPPED DATA IN RESPONSE TO THE CENTER BANDPASS DATA
GENERATE CENTER TO COMPOSITE POWER RATIO DATA IN RESPONSE TO THE CENTER POWER CLIPPED DATA AND THE COMPOSITE POWER DATA
616
GENERATE CENTER POWER CLIPPED DATA IN RESPONSE TO THE CENTER CLIPPED BAND PASS DATA
600
640
GENERATE DOUBLE TALK ACTIVITY PROBABILITY DATA IN RESPONSE TO THE CENTER POWER CLIPPED DATA, THE CENTER TO COMPOSITE POWER RATIO DATA AND THE DISTORTION DATA
650
660
ADJUST ECHO CANCELER ADAPTIVE FILTER COEFFICIENTS IN RESPONSE TO THE DOUBLE TALK ACTIVITY PROBABILITY DATA
670
END
ATTENUATE POST-ECHO CANCELER UPLINK AND/OR DOWNLINK DATA IN RESPONSE TO THE DOUBLE TALK ACTIVITY PROBABILITY DATA

FIG. 6

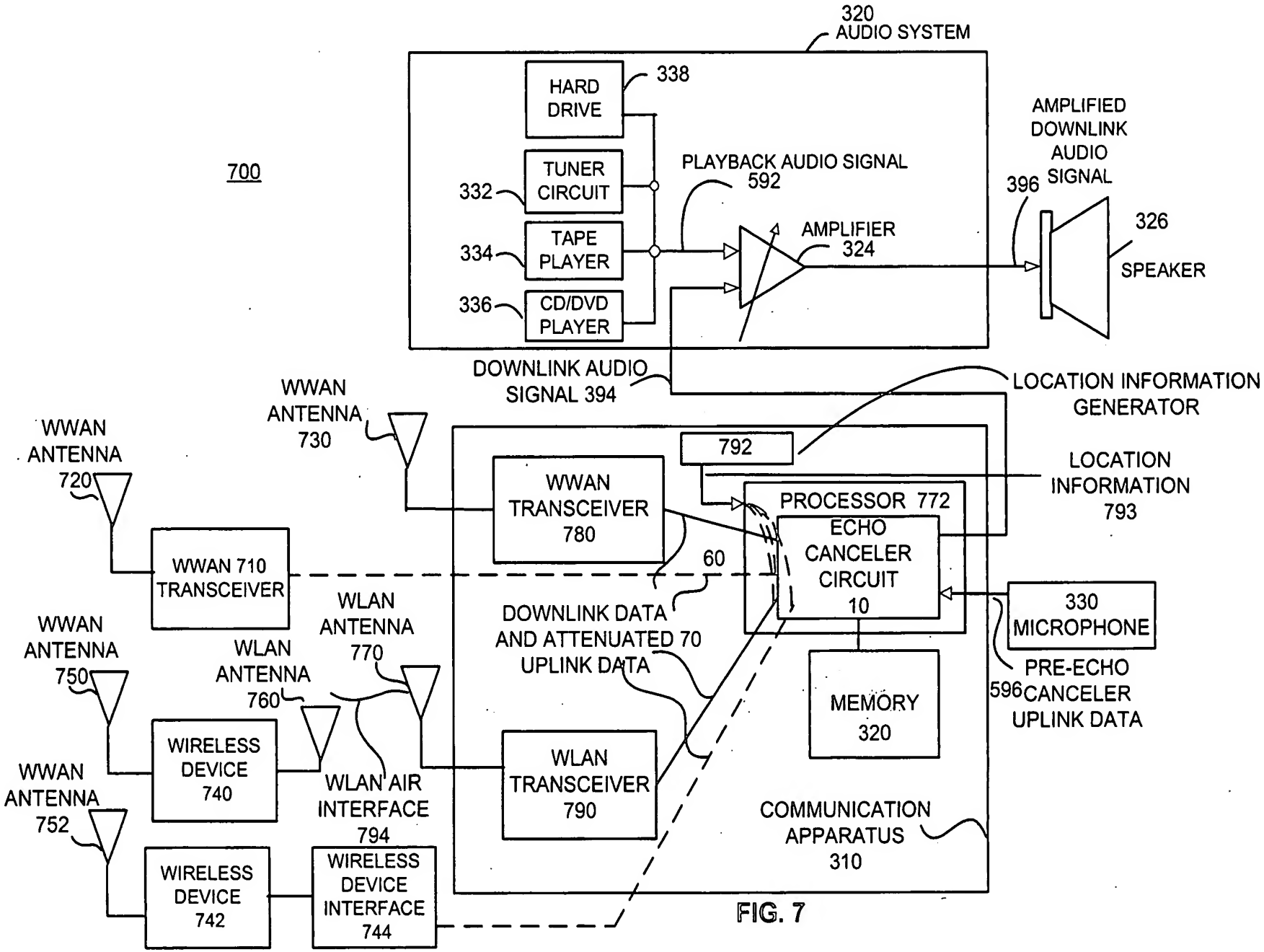
700
320
AUDIO SYSTEM
HARD DRIVE
338
TUNER CIRCUIT
332
TAPE PLAYER
334
CD/DVD PLAYER
336
PLAYBACK AUDIO SIGNAL
592
AMPLIFIER
324
AMPLIFIED DOWNLINK AUDIO SIGNAL
396
326
SPEAKER
DOWNLINK AUDIO SIGNAL 394
LOCATION INFORMATION GENERATOR
792
LOCATION INFORMATION
793
WWAN ANTENNA
730
WWAN ANTENNA
720
WWAN TRANSCEIVER
780
PROCESSOR 772
ECHO CANCELER CIRCUIT
10
60
WWAN 710
TRANSCEIVER
WLAN ANTENNA
770
WWAN ANTENNA
750
WLAN ANTENNA
760
DOWNLINK DATA AND ATTENUATED 70 UPLINK DATA
330
MICROPHONE
PRE-ECHO CANCELER UPLINK DATA
596
MEMORY
320
WIRELESS DEVICE
740
WWAN ANTENNA
752
WLAN AIR INTERFACE
794
WLAN TRANSCEIVER
790
COMMUNICATION APPARATUS
310
WIRELESS DEVICE
742
WIRELESS DEVICE INTERFACE
744

FIG. 7

IN-VEHICLE COMMUNICATION SYSTEM

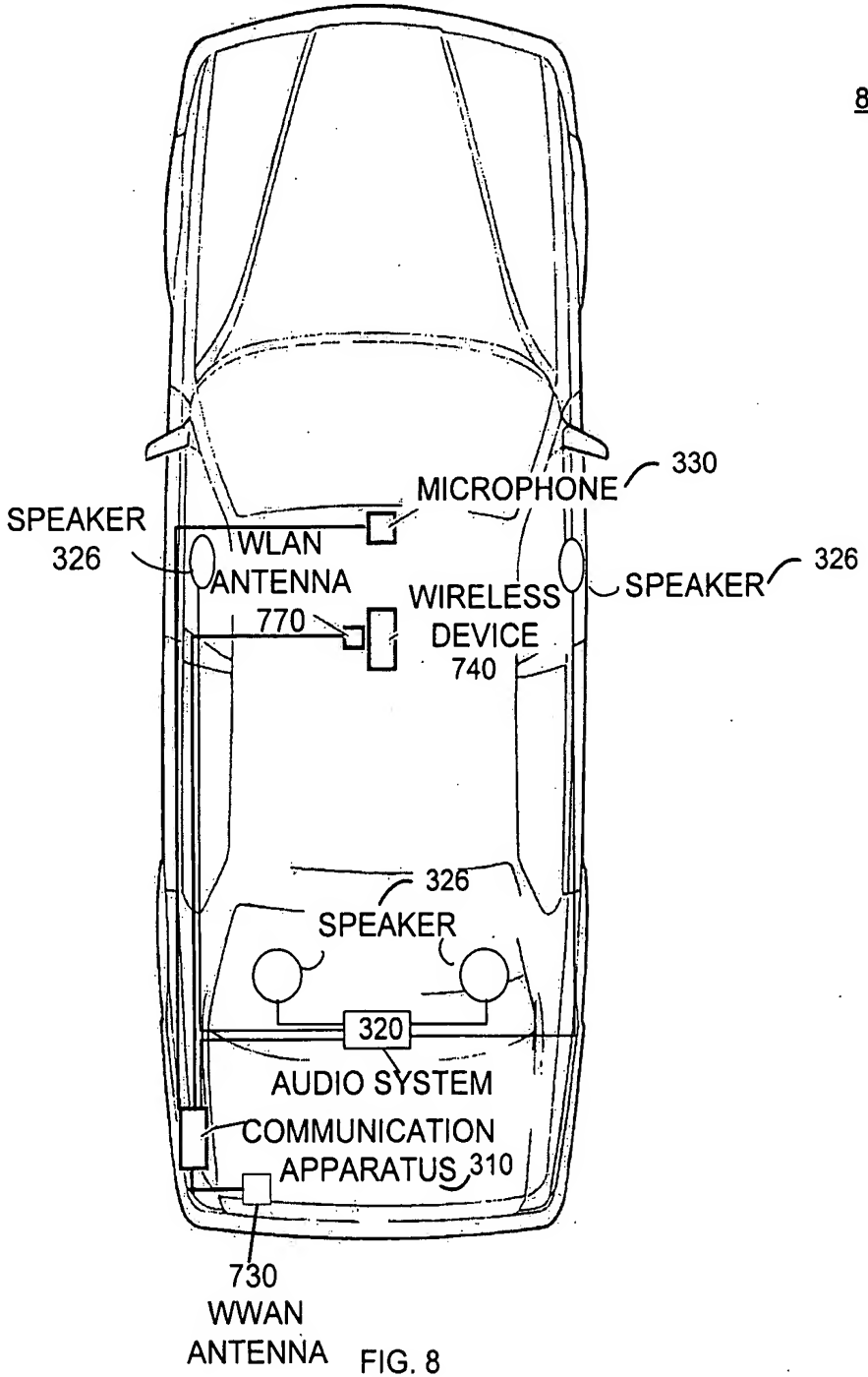

FIG. 8